SHIV NADAR UNIVERSITY
CHENNAI

(State Private University Established Under the Shiv Nadar University Act, 2018)

School of Engineering

Department of Computer Science and Engineering

End Semester Examinations, 2021-2022 Even

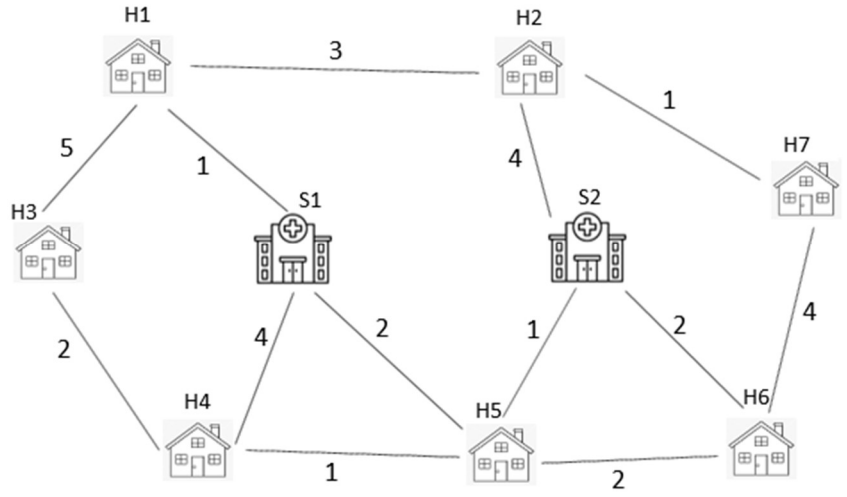
Question Paper

Name of the Programme: **B.Tech. Artificial Intelligence and Data Science**		Semester: **II**
Course Code & Name: **CS1006T DATA STRUCTURES**		
Regulations: **Regulation 2021**		
Time: **3 Hours**		Maximum: **100 Marks**

Q.No		Questions	Marks	CO#	KL#

1	a	`void func1(int N){`
		`  int x = 0;`
		`  for (int i = 0; i < N; i++)`
		`  x++;`
		`  return x;`
		`}`
		
		`void func2(int N){`
		`  if (N == 0)`
		`  return 0;`
		`  return (func2(N/2) + func1(N) + func2(N/2));`
		`}`
		Write the recurrence relation for func2 and solve it to calculate the time complexity of func2.
			5	CO1	KL3

2	a	Consider 2 linked lists **L** and **P** containing elements sorted in ascending order. Write a function which prints the elements in **L** which are in positions specified by **P**. For example, if **P** contains 1,2,5 and **L** contains 10,20,30,40,50, the function prints 10,20 and 50.	5	CO2	KL2
3	a	In an array implementation of a binary tree, the elements present from index 1 to index 10 are 15, 10, 18, 8, 13, 16, 20, 6, 9 and 11. i) Write the inorder traversal of the tree. ii) Find if the tree is a binary search tree.	5	CO3	KL2
4	a	Insert the following elements into a hash table of size M=7 using the hash function `h(x) = k mod M` where k is derived by taking the last 2 digits of the element to be inserted: 1436,1765,1463,1288,145,122,10,15377,345,12 Resolve collisions using linear probing method.	5	CO5	KL3
5	a	Explain time-space trade-off by comparing any one in-place sorting algorithm with the counting sort algorithm.	5	CO4	KL5

6	a	Draw the graph corresponding to the following adjacency matrix and write a valid DFS traversal for the graph. The vertices are numbered from 0 to 6. $\begin{bmatrix} 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix}$	5	CO3	KL3
7	a	Insert the elements 5,3,2,6,1,7 into a `min-heap` and draw the heap. Perform 2 `deleteMin()` operations on the heap and show the heap after each deletion.	5	CO3	KL3
8	a	For an input array 2,1,4,3,6,5,8,7, find the number of swaps done by the bubble sort algorithm and the number of swaps done by the insertion sort algorithm. What is your inference?	5	CO4	KL2
9	a	Write a program to implement the operations of a queue in a linked list. Using only those operations, implement the operations of a stack. You may use extra space if required.	10	CO2	KL5
	b	Consider two queues **Q1** and **Q2** with **Q1** containing some elements. Write an algorithm to place the elements of **Q1** in **Q2** in reverse order using only valid queue operations without using extra space. Eg. If **Q1** contains 2,4,5,6, the elements should be placed in **Q2** as 6,5,4,2.	5	CO2	KL6
10	a	Insert the following elements into a splay tree: 12,15,16,17,18,23,10,9,8,7,1,5,3,25,20 In the resultant splay tree, perform `find()` operation for the elements 16, 9, 5. You must draw the splay tree after each insertion and find operation.	15	CO3	KL3
11	a	In a small town, they plan to set up a new hospital. There are 2 sites which are considered to set up the hospital. It is decided that the hospital be built at the site which is nearest to all the houses. The map of the town is given below. **H1** to **H7** are the houses and **S1** and **S2** are the proposed sites for the hospital. Use a single source shortest path algorithm to find shortest distances from site1 to all the houses and then site2 to all the houses. With the results, find which site would be more suitable to set up the hospital.  	15	CO3	KL4

12	a	Consider the following keys to be inserted into a hash table of size 100. 125,630,219,455,243,953,154,234,643,127,527,853 Insert the keys using multiplication method of hashing with the constant A=0.618033. Use separate chaining for collision resolution.	8	CO5	KL3
	b	Insert the keys given in 12a into a hash table using division method with quadratic probing for collision resolution. For quadratic probing, the values of constants are c1=1 and c2=3.	7	CO5	KL3

KL – Bloom's Taxonomy Levels

(KL1: Remembering, KL2: Understanding, KL3: Applying, KL4: Analyzing, KL5: Evaluating, KL6: Creating)

CO – Course Outcomes
